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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/676,082	10/02/2003	Minoru Toriumi	025311-0122	7767
22428	7590	05/17/2005	EXAMINER	
FOLEY AND LARDNER SUITE 500 3000 K STREET NW WASHINGTON, DC 20007			HU, HENRY S	
			ART UNIT	PAPER NUMBER
			1713	

DATE MAILED: 05/17/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/676,082

Applicant(s)

TORIUMI, MINORU

Examiner

Henry S. Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on IDS of 7-15-2004.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2-4, 7, 11 and 15-20 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-4, 7, 11 and 15-20 is/are rejected.
- 7) ☒ Claim(s) 15 is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 02 October 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>4 pages</u> .   | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

1. It is noted that this application is a **DIV of 09/986,048 abandoned on March 19, 2004**. This Office Action is in response to **Pre-Amendment** filed with this application on October 2, 2003. Claims 1, 5-6, 8-10 and 12-14 were canceled, while Claims 2-4, 7 and 11 were rewritten to become method claims and to be dependent from parent Claim 15.

In response to specification objection in previous action for the abandoned parent case, the paragraph from page 10 at line 31 was replaced with a new paragraph to correct the informalities on “**tetrafluoroethylene** is spin-coated on the anti-reflective coating 2” as pointed out by the examiner. The Applicants have also provided a statement regarding the use of “**super pure water**” on Claims 11-14. **Claims 2-4, 7, 11 and 15-20 are now pending.** An action follows.

### *Claim Objections*

2. Claim 15 is objected to because of the following informalities:

On **Claim 15** at line 5, phrase of “**according to claim 1**” is improper since Claim 15 is supposed to be in independent form according to the above-mentioned pre-amendment filed on October 2, 2003. Therefore, the Applicants need to add all the limitations of the cancelled Claim 1 into Claim 15 for anti-reflective coating.

***Claim Rejections - 35 USC § 102***

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. *The limitation of parent Claim 15 of the present invention relates to a method for manufacturing a semiconductor device, comprising:*

(A) *an anti-reflective coating forming step for forming an anti-reflective coating by coating the composition for an anti-reflective coating according to claim 1 on a semiconductor substrate;*

(B) *a resist film forming step for forming a resist film containing fluorine on the anti-reflective coating formed in said anti-reflective coating forming step; and*

(C) *an exposure step for radiating exposure light onto the resist film formed in said resist film forming step.*

*See other limitations of dependent Claims 2-4, 7, 11 and 16-20.*

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5. Claims 2, 11 and 15-20 are rejected under 35 U.S.C. 102(e) as being anticipated by Padmanaban et al. (US 6,365,322 B1).

Regarding the limitation of parent **Claim 15**, **Padmanaban et al.** disclose specifically a method to produce a semiconductor device by **coating a photoresist composition solution onto a bottom antireflective coated (B.A.R.C.) silicon substrate**, wherein the bottom anti-reflective coating solution is **ArF-1** from Clariant Corp., and the coated substrate can be baked dry and then imagewise exposed to actinic radiation, x-ray, electron beam, ion beam or laser radiation (column 7, line 30 – column 8, line 67; for microlithography process see column 1, line 12-29). **Padmanaban et al.** further disclose that such a photoresist material can be **a fluorinated polymer when 157 nm is applied** as long as it is optically transparent at that wavelength (column 2, line 15-33). With respect to the fluorine-containing polymer for antireflective coating, Clariant's **ArF-1 is a fluorinated polymer of poly(aromatic ether) (FPAE) as known in the art.**

6. Regarding **Claims 16-19 and 2**, the bottom antireflective coated (B.A.R.C.) silicon substrate was prepared by spin coating **ArF-1** fluoropolymer's solution onto a silicon wafer substrate and then was baked at **200 °C for 60 sec** (column 8, line 51-55). Nitrogen atmosphere drying is not disclosed as a required condition. The thickness of BARC film after drying is kept at **82 nm** (column 8, line 55-56).

Regarding **Claim 20**, the wavelength of the exposure light or radiation on photoresist is in the range of **100-300 nm**, particularly at **248, 193 and 157 nm** (column 2, line 15-33).

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Regarding **Claim 11**, the solvent used for the **non-crosslinked** fluorine-containing polymer in making antireflective coating would be different from those used for photoresist composition. Suitable solvent for photoresist composition may include propylene glycol mono-alkyl ether, xylene, amyl acetate and the like (column 7, line 5-10).

***Claim Rejections - 35 USC § 103***

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

- (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

8. Claims 2, 11 and 15-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujie et al. (US 6,303,264 B1) in view of Padmanaban et al. (US 6,365,322 B1).

Regarding the limitation of parent **Claim 15**, Fujie et al. have disclosed a method to produce a semiconductor device by **coating a fluorinated photoresist composition solution onto a silicon wafer substrate**, and the coated substrate can be baked dry and then imagewise exposed to radiation through a mask (abstract, line 1-15; column 2, line 6- 47; for microlithography process see column 1, line 5-63). Fujie et al. further disclose that such photoresists can be **a fluorinated polymer** as long as it is optically transparent at the desired wavelength (column 18, line 55-65; column 6, line 43-67; column 7, line 47-49).

9. The Fujie reference is silent about first putting a **bottom antireflective coating for photoresist film**. Padmanaban et al. teach specifically a method to produce a semiconductor device by **coating a fluorinated photoresist composition solution onto a bottom antireflective coated (B.A.R.C.) silicon substrate**, wherein the bottom anti-reflective coating solution is ArF-1 from Clariant Corp. which is **a fluorinated polymer of poly(aromatic ether) (FPAE) as known in the art**. By doing so, an advantage is to obtain a photoresist device sensitive to radiation in the deep ultraviolet, particularly in the range of 100-300 nm.

In light of the fact that the involved references are preparing the same or similar type of fluorinated film deposition or coating for photoresist application, one having ordinary skill in the art would therefore have found it obvious to add **a bottom antireflective fluorinated coating** such as ArF-1 fluoropolymer as taught by Padmanaban. By this modification, one would expect to obtain a photoresist device sensitive to radiation in the deep ultraviolet, particularly in the

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range of 100-300 nm. Thereby a better and more diversified photoresist product can be obtained.

10. Regarding **Claims 16-19 and 2**, Padmanaban teaches that the bottom antireflective coated (B.A.R.C.) silicon substrate can be prepared by spin coating **ArF-1** fluoropolymer's solution onto a silicon wafer substrate and then was baked at **200 °C for 60 sec** (column 8, line 51-55). Nitrogen atmosphere drying is not disclosed as a required condition. The thickness of BARC film after drying is kept at **82 nm** (column 8, line 55-56).

Regarding **Claim 20**, Padmanaban teaches that the wavelength of the exposure light or radiation on photoresist is in the range of **100-300 nm**, particularly at **248, 193 and 157 nm** (column 2, line 15-33).

Regarding **Claim 11**, the solvent used for the **non-crosslinked** fluorine-containing polymer in making antireflective coating would be different from those used for photoresist composition. Suitable solvent for photoresist composition may include propylene glycol mono-alkyl ether, xylene, amyl acetate and the like (column 7, line 5-10).

11. Claims 3-4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujie et al. (US 6,303,264 B1) in view of Padmanaban et al. (US 6,365,322 B1) as applied to Claims 2, 11 and 15-20, and further in view of Matsuo et al. (US 5,510,406).



The discussion of the disclosures of the prior art of Fujie/Padmanaban for Claims 2, 11 and 15-20 of this office action is incorporated here by reference. Regarding **Claims 3-4 and 7**, Fujie/Padmanaban is **silent on the fluoropolymer about two things as (A) comprising the claimed monomeric unit(s) (Claims 3 and 4), and (B) the crosslinkable feature** in the polymer (Claim 7). **Matsuo** et al. teach the fluoropolymers can be made from both requirements (A) and (B) (see **monomers** at column 1, line 56 – column 5, line 13; see **crosslinkable monomer** at column 5, line 36 – column 7, line 3). By doing so, an advantage is to obtain a crosslinked fluoropolymer coating having a high fluorine content, a low refractive index and a high transparency, which is particularly useful as a cladding material for optical fiber without peeling off from core material (column 11, line 40-45).

In light of the fact that the involved references are preparing the same or similar type of fluorinated film deposition or coating for optical application, one having ordinary skill in the art would therefore have found it obvious to replace or modify Fujie/Padmanaban's anti-reflective fluorinated polymer by using the same crosslinkable polymer or adding the same crosslinkable monomeric unit for copolymerization as taught by Matsuo. By replacement or modification on fluoropolymer, one would expect to obtain an anti-reflective coating with a high fluorine content, a low refractive index and a high transparency **without peeling off from substrate or core material**. Thereby a better and more diversified photoresist product can be obtained.

12. Claims 3-4 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Padmanaban et al. (US 6,365,322 B1) in view of Matsuo et al. (US 5,510,406).

The discussion of the disclosures of the prior art of Padmanaban for Claims 2, 11 and 15-20 of this office action is incorporated here by reference. Regarding **Claims 3-4 and 7**, Padmanaban is **silent on the fluoropolymer about two things as (A) comprising the claimed monomeric unit(s)** (Claims 3 and 4), **and (B) the crosslinkable feature** in the polymer (Claim 7). Matsuo et al. teach the fluoropolymers can be made from both requirements (A) and (B) (see **monomers** at column 1, line 56 – column 5, line 13; see **crosslinkable monomer** at column 5, line 36 – column 7, line 3). By doing so, an advantage is to obtain a crosslinked fluoropolymer having a high fluorine content, a low refractive index and a high transparency, which are particularly useful as a cladding material for optical fiber without peeling off from core material (column 11, line 40-45).

In light of the fact that the involved references are preparing the same or similar type of fluorinated film deposition or coating for optical application, one having ordinary skill in the art would therefore have found it obvious to replace or modify Padmanaban's anti-reflective fluorinated polymer by using the same crosslinkable polymer or adding the same crosslinkable monomeric unit for copolymerization as taught by Matsuo. By replacement or modification on fluoropolymer, one would expect to obtain an anti-reflective coating with a high fluorine content, a low refractive index and a high transparency **without peeling off from substrate or core material**. Thereby a better and more diversified photoresist product can be obtained.

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*Conclusion*

13. The prior art made of record and not relied upon is considered pertinent to applicants' disclosure. The following references relate to a method for forming a fluorine-containing resist film on the top of an anti-reflective film:

US Patent No. **6,329,117 B1 to Padmanaban et al.** has disclosed a method to produce a semiconductor device by **coating a photoresist composition solution onto a bottom antireflective coated (B.A.R.C.) silicon wafer substrate**, wherein the bottom anti-reflective coating solution is **crosslinkable but is not fluorinated at all** (column 4, line 37 – column 9, line 19). Additionally, the photoresist composition material is not fluorinated at all (column 11, line 65 – column 12, line 49). Therefore, Padmanaban fails to teach or fairly suggest using fluorinated polymers on both coatings of present invention.

14. Any inquiry concerning this communication or earlier communication from the examiner should be directed to Henry S. Hu whose telephone number is **(571) 272-1103**. The examiner can be reached on Monday through Friday from 9:00 AM – 5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Wu, can be reached on (571) 272-1114. The fax number for the organization where this application or proceeding is assigned is (703) 872-9306 for all regular communications.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Henry S. Hu

Patent Examiner, Art Unit 1713, USPTO

May 12, 2005



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